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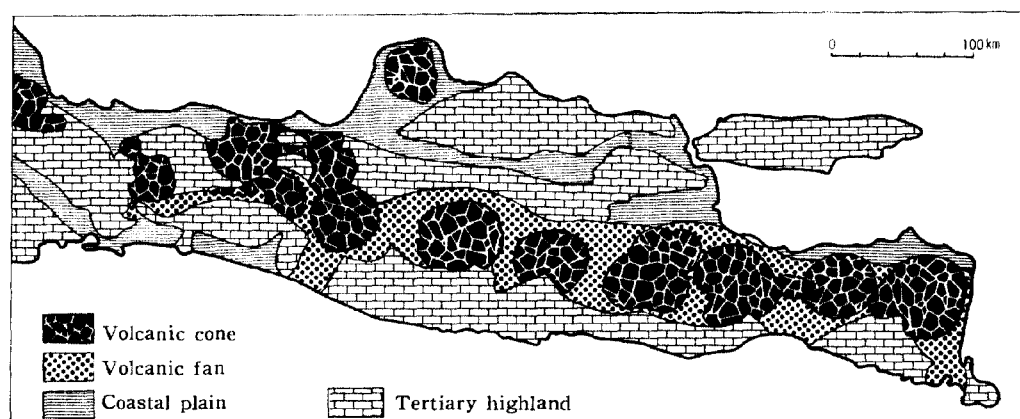
## Land Use Pattern in Indonesia

by

Eiji MATSUMOTO\* and SUVIJANT\*\*

### I Four Geological Bodies of Different Genesis

From the geological and geographical viewpoints, Java and Madura Islands can be divided into four units of different nature, namely, volcanic cone, volcanic fan, coastal plain and Tertiary highland. If the water, soil and microrelief are taken into consideration, the following subdivision becomes possible. (Fig. 1)



**Fig. 1** Map showing the four patterns of land use in the Central and East Java and in Madura Island

- |                         |                           |
|-------------------------|---------------------------|
| 1. Volcanic cone        | 2. Volcanic fan           |
| 1-a) Upper part         | 2-a) Upper part           |
| 1-b) Lower part         | 2-b) Lower part           |
| 3. Coastal plain        | 4. Tertiary highland      |
| 3-a) Alluvial lowland   | 4-a) Limestone plateau    |
| 3-b) Quaternary terrace | 4-b) Less-calcareous hill |

Many volcanoes, which were formed during the period between Miocene and Holocene, are distributed along the axis of Java Island. Most of the volcanoes are

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strato-volcanoes and conical in shape. Every volcano can be divided into two parts, that is, volcanic cone and volcanic fan. The former comprises the main portion of a volcano including its peak and the greater part of the steeply sloping upper portion. The volcanic cone is dominantly composed of hard volcanic rocks, while the volcanic fan, skirting the foot of a volcano, is composed of volcanic detritus which were carried down from the volcanic cone by fluvial action. The slope of the fan is gentler than the volcanic cone but steeper than the adjoining Alluvial plain. On the north and south coasts of Java Island are developed narrow coastal plains. Geographically, they are classified into two types, the Alluvial lowland of low elevation and small relief, and the Quaternary terrace with higher elevation and moderately relieved surface.

Between the volcanic axis and the coastal plain is developed the Tertiary highland, which can be subdivided into two parts, a region of limestone plateau and a region of less-calcareous hill. The limestone plateau is chiefly composed of limestone with shaly layers. General elevation is ca. 600 m. The less-calcareous hill is composed of alternating layers of sandstone and shale with some calcareous and conglomerate beds. The strata dip  $45^\circ$  in maximum to the north and the south, thus forming a cuesta topography.

## II Land Use Pattern

### 1. Volcanic cone

In spite of its steep slopes, the volcanic cone of Java is important for agriculture because of its favorable hydrographic condition. The volcanic cone may be better understood by subdividing it into the upper and the lower part, in terms of land use pattern. (Figs. 2 and 3)

#### 1-a) Upper part

The upper part of volcanic cone is a region above approximately 600 m where such trees as pine and citrus begin to appear. This region belongs to a temperate zone climatologically. In this region, such vegetables as potato, cabbage and Welsh onion are grown and tea plantation is also carried out. In the sense of the land use pattern the region may be defined as a region of plantation.

#### 1-b) Lower part

The lower part of volcanic cone is a region below 600 m. The steep slopes of volcano have been terraced and leveled into paddy fields where water is supplied from springs. In some places, terraced fields may be so narrow that they comprise only several rows of rice plants, because of the steepness. Draining is done from terrace to terrace. The places where no spring has been found remain uncultivated for paddy field, but are locally utilized for rubber plantation.

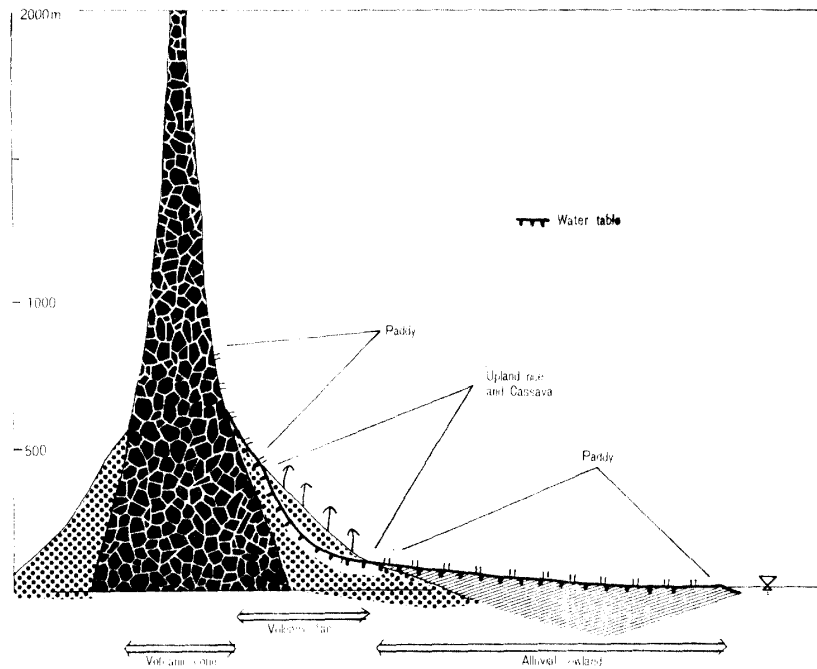


Fig. 2 Schematic cross section through volcano and coastal plain showing land use pattern

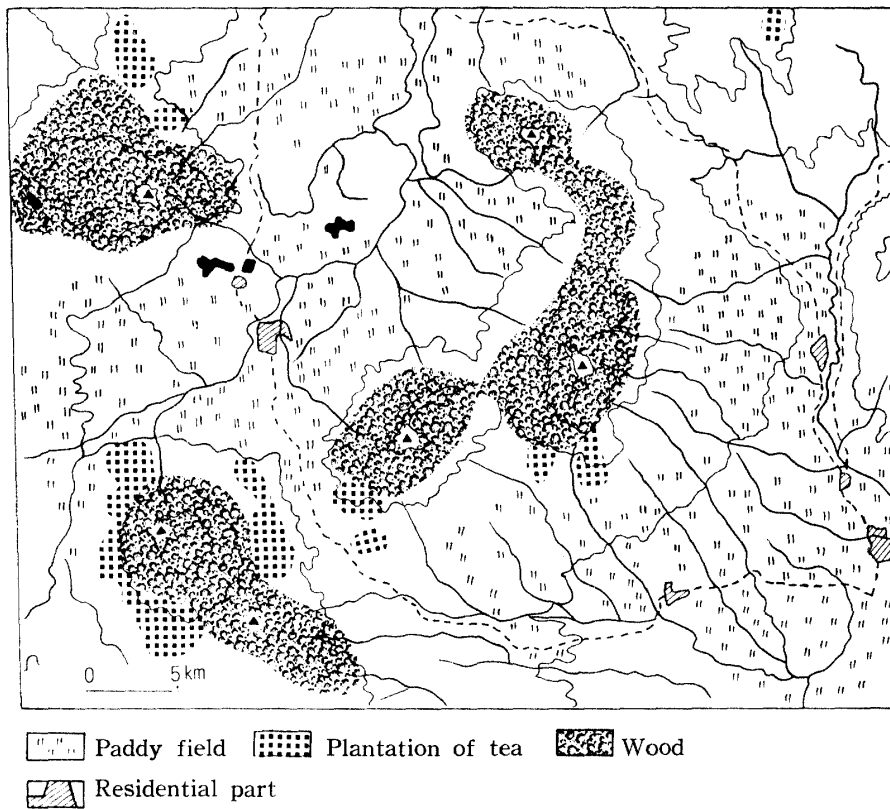


Fig. 3 Map showing the land use pattern in volcanic cone and fan

## 2. Volcanic fan

Volcanic fan consisting of volcanic detritus transported by running water is found around the foot of a volcano. Volcanic fan has a somewhat gentle slope and is widely terraced into paddy fields. The landscape of this area is characterized by the network of irrigation canals and the light railway which had been laid extensively during the colonial period to gather sugar cane. On the basis of the topographical features and the water condition, the volcanic fan can be divided into the upper part and the lower part.

### 2-a) Upper part

In this area, the potentiality of water supply from surface water is very high. Thanks to this hydrographic advantage, the area has been terraced and leveled, with the canals about 5 m wide. The rotational cropping of rice and sugar cane has been applied in this area. Cultivation of rice plants is carried out by transplanting, and irrigation is performed from terrace to terrace. Beans and other crops are planted as the second crop after rice. The acreage of sugar cane plantation has been decreasing, yet farmers are still expected to cultivate certain acreage for sugar cane because of the ration system imposed by the government.

### 2-b) Lower part

In this area, the potentiality of water supply from surface water is very low, because of the sandy soil which permeates water. The gogo rice of this area is characteristic. When the water supply is insufficient, the gogo rice remains as upland rice, but the water supply is sufficient, it grows as wet rice. In somewhat elevated places, where the water supply is more difficult, cassava and maize are planted.

## 3. Coastal plain

In the northern and southern parts of the island are developed narrow coastal plains, comprising two geographical elements, Alluvial lowland and Quaternary terrace.

### 3-a) Alluvial lowland

Alluvial lowland is distributed seaward in the coastal plain. It is very flat and low, covered with Alluvial soil. The Alluvial lowland east of Semarang often suffers inundation during the wet season. In such a place, the rice planting is carried out by broadcast-sowing. On the whole, the Alluvial lowland is easy to manage on account of water depth regularity and the rice cultivation is usually performed by transplanting.

### 3-b) Quaternary terrace

Quaternary terrace of relatively large relief and covered with red soil is distributed landward in the coastal plain. On the terrace are planted rubber and cassava. Teak and mahogany are also afforested there, and the acreage of afforestation is

growing at the expense of the rubber plantation.

#### 4. Tertiary highland

Tertiary highland can be divided into two parts, limestone plateau and less-calcareous hill.

##### 4-a) Limestone plateau

Limestone plateau is very poor in water supply and is scarcely covered by vegetation. On the basis of the topographical situation and the soil condition, the limestone plateau can be divided into two parts, i.e, the swaly part covered with black soil called grumsol, and the swelly part covered with red soil called red Mediterranean soil. The black-soil area is cultivated for gogo rice with the help of bunds. Some gogo rice fields are leveled twice a year, first in August and again sometime between September and November. After that, gogo rice seed are broadcasted during a period from November to December. Soya bean and maize are planted after rice as the second crops of the dry season. The red-soil area is utilized in cassava and maize planting. In this area, the acreage of teak and mahogany afforestation has increased drastically. Such spacious plantation of these trees is never found on the topographical maps published in 1945. Paddy cultivation is negligible in the limestone plateau.

##### 4-b) Less-calcareous hill

The less-calcareous hill is composed of two topographical elements, river and hillside. Rivers dissect the Tertiary strata, and thin deposits of fluvial origin are found on the river-bed. Since the Tertiary hill region has lesser availability of water due to smaller catchment than volcanic region, paddy cultivation is limited to the river-bed which serves as a conduit in the region. In the marginal zone between the river-bed and the side slope, cassava and maize are planted. Such trees as mango, coconut palm, papaya and banana are planted on higher slopes, accompanied by rubber and coffee plantation. (Fig. 4)

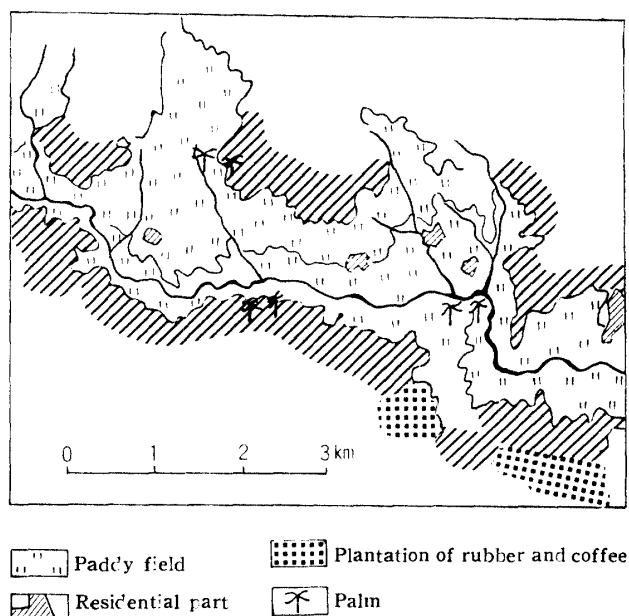


Fig. 4 Map showing the land use pattern in the less calcareous region of Tertiary highland

### III Future Prospect

With regard to the future prospects of land use in Java Island, the following facts are pointed out.

#### 1-a) Upper part of volcanic cone

This area has very small potentiality of rice cultivation, being hindered by steep rocky slopes and extremely localized water supply. If easy access was provided, the track farming of temperate vegetable would be possible in limited area where soil can retain moisture.

#### 1-b) Lower part of volcanic cone

In this area, there are more than enough paddy fields where water supply from spring is sufficient. But if a new underground water reservoir was found by means of electric prospecting, a larger area could be turned into paddy fields.

#### 2-a) Upper part of volcanic fan

In this area, the water supply by irrigation canals is fairly sufficient and production of rice per unit area is high and stable. However, it still leaves some room for improvement to increase the yield per unit area. At present, draining is done from terrace to terrace, but in this manner fertilizer would be washed away from terrace to terrace. If the supply and drainage of water is done directly from and to the waterway, fertilizer can be more effectively given to the paddy field. By the above-mentioned improvement, an increase in the rice production per unit area can be expected.

#### 2-b) Lower part of volcanic fan

In this area, water supply from surface water is insufficient, so that gogo rice and cassava are planted in the greater part of the area. But this area has some potentiality of water supply from shallow-seated underground water. By drawing up the underground water with pumps, the gogo rice and cassava fields can be transformed into paddy fields.

#### 3-a) Alluvial lowland

With regard to water supply, the Alluvial lowland can be divided into two types. One is an area where inundation occurs every year and rice is grown by broadcast-sowing. In this area, the drainage canals should be built so as to replace broadcasting by planting. The other is an area where water supply is insufficient and salt injury occurs. To maintain an adequate volume of water during the dry season, construction of a dam is needed and to protect against salt injury, construction of an estuary dam is needed. By those means of improvement, not only the rice-growing season would be stabilized but also the second rice planting would be possible.

3-b) Quaternary terrace

The Quaternary terrace is an area where water supply is insufficient and the plantation of rubber and afforestation of teak are carried out. Cassava and maize are also planted. If a dam is constructed to reserve the water of near-by rivers and the waterways are arranged so as to distribute the drawn water widely, paddy fields will be largely expanded.

4-a) Limestone plateau

The soil covering the limestone plateau is very clayed, and in the dry season large cracks are developed everywhere, thus hardly retaining water. Because of this disadvantageous soil property, this area is unsuitable for planting wet rice. Even the cultivation of gogo rice cannot be profitable. The soil of this area may be suitable for tobacco and cotton plantation.

4-b) Less-calcareous hill

Some portions of wooded slopes may be feasible for gogo rice cultivation. But since the area is inclined, appropriate measures to prevent soil erosion should be taken.

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